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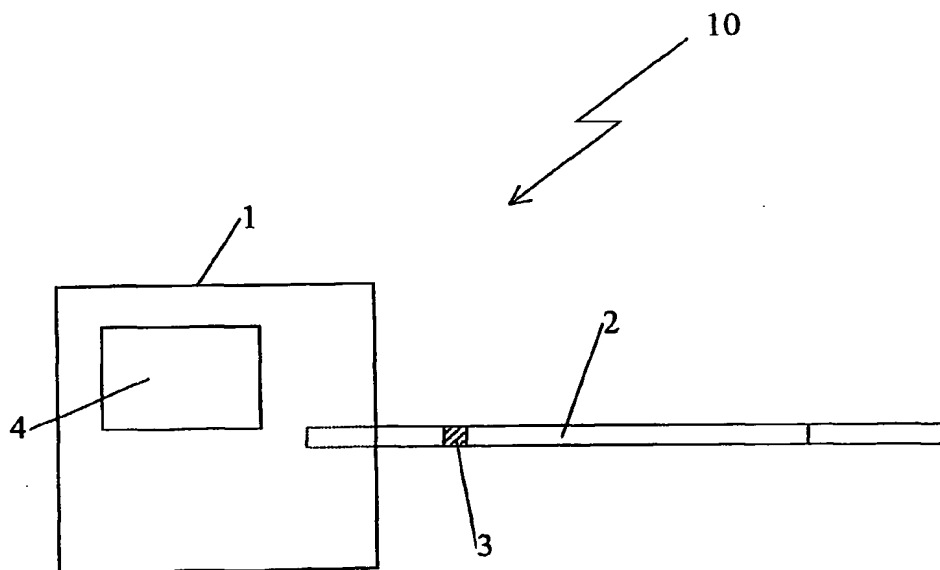
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- (71) Applicant (for all designated States except US): **DIOMED LIMITED** [GB/GB]; Cambridge Research Park, Ely Road, Cambridge CB5 9TE (GB).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **HOWE, Christopher, Andrew** [GB/GB]; 59 Ward Way, Witchford, Ely, Cambs. CB6 2JR (GB). **DE St., Paer-Gotch, Edmund, Hugh, Emile** [GB/GB]; 23 Athelstan Gardens, Wickford, Essex SS11 7EE (GB).
- (74) Agent: **FRANK, B. DEHN & CO.**; 179 Queen Victoria Street, London EC4V 4EL (GB).
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(54) Title: LASER SYSTEM



(57) Abstract: A laser system (10) is disclosed comprising a laser device (1) for emitting laser radiation and an optical fibre (2) adapted to connect, in use, to the laser device (1) for delivering the laser radiation. The optical fibre contains a label (3), such as an RF identification tag, a barcode or a colour code. The laser device (1) interrogates the optical fibre (2) and receives information back from the optical fibre (2). If the usage of the optical fibre (2) has exceeded safety limits then the laser device (1) may be prevented from operating. The laser device (1) on receiving information from the optical fibre (2) may also be configured to deliver laser radiation having a specific power, pulse width, pulse interval and treatment duration.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

LASER SYSTEM

5 The present invention relates to a laser system and a method of operating a laser system.

Medical lasers are used in certain medical procedures to administer thermal or other energy to a patient with beneficial effects. For example, energy
10 can be used to detect or treat a tumour or a region of the body, or to destroy or denature diseased or malfunctioning body tissue. US-6095149 describes, for example, the treatment of intervertebral disc abnormalities with thermal energy. Other forms of medical treatment
15 utilise laser energy such as endovenous laser treatment (EVLV) wherein laser energy is delivered to the inner wall of a vein.

A known laser system comprises a laser device for emitting laser radiation and an optical fibre for
20 directing the laser radiation to the required location. The laser system may be used for a variety of different purposes and optical fibres for use with the laser device may be provided with a standard connector for attachment to the laser device.

25 Optical fibres used in conjunction with a laser device may, in certain circumstances, have a relatively limited lifetime. For example, the lifetime of an optical fibre may be limited due to hygiene requirements in medical applications. An optical fibre may
30 additionally/alternatively also have a limited lifetime before it becomes susceptible to damage.

A laser device may have been initially calibrated with a new optical fibre to deliver a certain intensity laser beam. However, if the optical fibre is reused a

number of times then the presence of dirt etc. on the optical fibre may result in a lower than desired intensity laser beam being delivered which, for example in medical applications, could render the intended medical treatment ineffective.

In some applications optical fibres may only be intended for single use and should be disposed of thereafterwards for health and safety reasons.

According to an aspect of the present invention there is provided a laser system comprising:

a laser device for emitting laser radiation; and
a delivery device adapted to connect, in use, to the laser device for delivering the laser radiation; wherein, in use, the laser device receives information from the delivery device.

An advantage of the preferred embodiment is that an operator can be certain that a correct, safe and effective optical fibre or other delivery device has been attached to the laser device and that the optical fibre or other delivery device is suitable for the intended use. This may be particularly important in medical applications.

The delivery device is preferably an optical fibre and the laser device preferably includes a detector for detecting the connection of the delivery device. The laser device preferably interrogates the delivery device after detecting the connection. The laser device preferably interrogates the delivery device or optical fibre in a contactless manner.

Information is preferably encoded, embedded within or otherwise stored with the delivery device and may

indicate the type, usage, state, age, intended use and/or function of the delivery device.

According to a preferred embodiment the delivery device comprises an AC or RF identification tag or
5 transponder. The identification tag may be either a read only device or in an alternative embodiment a read/write device.

The laser device preferably comprises an AC or RF identification reader for reading the AC or RF
10 identification tag or transponder. In use, the delivery device preferably transmits or returns a signal to the AC or RF identification reader.

According to a preferred embodiment the delivery device receives, in use, a power pulse. The delivery
15 device preferably receives AC or RF energy, stores the energy and then transmits back to the laser device data or information using the stored energy.

According to a less preferred embodiment the delivery device may comprise a barcode and the laser
20 device may comprise a barcode reader.

According to another less preferred embodiment the delivery device may comprise a colour identification tag and the laser device may identify the colour identification tag.

25 The laser device preferably comprises a SMA-905 connector for receiving an optical fibre.

According to a preferred embodiment in a mode of operation the laser device prevents operation with the delivery device upon receiving information from the
30 delivery device. In a mode of operation the laser device may prevent operation with the delivery device if the laser device does not receive any information from

the delivery device. The laser device may also prevent operation if a conventional delivery device known per se, for example a known delivery device which does not transmit information to the laser device, is connected to the laser device.

The laser device may in a mode of operation prevent operation with the delivery device if the laser device receives information from the delivery device and wherein the information indicates a predetermined parameter is unsuitable or has been exceeded. The parameter may, for example, indicate the usage, sterility, type and/or expiry date of the delivery device. If the laser device does disable or limit operation with a delivery device then in a mode of operation the laser device may be enabled and/or disabled remotely, for example via a telephone link, a serial interface, via the internet or other means.

The laser device may be provided with a visual display adapted to provide the user with information received from the delivery device.

According to a preferred embodiment in a mode of operation the laser device receives information from the delivery device and sets the power and/or pulse width and/or interval between pulses and/or duration of laser radiation to be transmitted to the delivery device and hence delivered by the delivery device. Advantageously, this enables the laser device to be safely operated without requiring a skilled technician to control the operation of the laser device.

According to another aspect of the present invention there is provided an optical fibre assembly

comprising an AC or RF identification tag or transponder.

According to another aspect of the present invention there is provided a laser device comprising a
5 reader for reading an AC or RF identification tag or transponder on an optical fibre assembly.

According to another aspect of the present invention there is provided a laser system comprising:

an optical fibre assembly comprising an AC or RF
10 identification tag or transponder; and
a laser device comprising a reader for reading the AC or RF identification tag or transponder.

According to another aspect of the present invention there is provided an optical fibre comprising
15 a barcode.

According to another aspect of the present invention there is provided a laser device comprising a barcode reader for reading a barcode on an optical fibre.

20 According to another aspect of the present invention there is provided a laser system comprising:
an optical fibre comprising a barcode; and
a laser device comprising a barcode reader for reading the barcode.

25 According to another aspect of the present invention there is provided a laser system comprising:
a laser device for emitting laser radiation; and
a delivery device adapted to connect, in use, to the laser device for delivering the laser radiation, the
30 delivery device comprising a read/write device for storing information;

wherein, in use, the laser device updates the information on the read/write device.

Preferably, the laser system in accordance with any aspect of the present invention comprises a medical laser system.

According to another aspect of the present invention there is provided a medical laser system comprising:

a laser device for emitting laser radiation; and
a delivery device adapted to connect, in use, to the laser device for delivering the laser radiation; wherein, in use, the laser device receives information from the delivery device.

According to another aspect of the present invention there is provided a method of operating a laser system comprising the steps of:

providing a laser device; and
connecting a delivery device to the laser device; wherein said laser device receives information from the delivery device.

According to another aspect of the present invention there is provided a method of operating a laser system comprising providing a laser device and a delivery device wherein the laser device interrogates the delivery device. Preferably, the laser device detects the attachment of the delivery device prior to interrogating the delivery device.

According to another aspect of the present invention there is provided a method of operating a laser system comprising the steps of:

providing a laser device; and
attaching a delivery device to the laser device;

wherein the laser device detects the attachment of the delivery device and interrogates the delivery device upon detection of the attachment of the delivery device.

Preferably, the method of any aspect of the present invention further comprises the laser device enabling operation of the laser system upon receiving information from the delivery device.

The laser device preferably receives information from the delivery device and displays the information for the user. The information received by the laser device from the delivery device may preferably indicate the usage, sterility, type or expiry date of the delivery device.

A method of operating a laser system in accordance with any aspect of the present invention may preferably further include in a mode of operation the laser device being enabled and/or disabled remotely.

According to another aspect of the present invention there is provided a method of operating a laser system comprising the steps of:

providing a laser device;
attaching a delivery device to a laser device; and
transmitting a power pulse to the delivery device;
wherein the delivery device receives the pulse,
stores the pulse and transmits data to the laser device using the pulse. The pulse is preferably a pulse of AC or RF energy.

Preferably, the laser device may receive information from the delivery device and configure the operation of the laser device.

Various embodiments of the present invention will now be described, by way of example only, and with reference to the accompanying drawing in which:

Fig. 1 shows a laser system according to the preferred embodiment.

A preferred embodiment of the present invention will now be described with reference to Fig. 1. A laser system 10 is shown comprising a laser device 1 for emitting laser radiation and a delivery device 2 adapted and arranged to be connected to the laser device 1.

According to the preferred embodiment, the laser device 1 is an 810 nm diode laser manufactured by DIOMED, Ltd., United Kingdom and the delivery device 2 is an optical fibre. The delivery device 2 may be connected to the laser device 1 using any suitable connector/fibre terminator such as a standard sub-miniature A (SMA) connector. Alternatively, according to a less preferred embodiment, the delivery device may comprise a mirror based delivery system.

The delivery device 2 is preferably fully compatible with existing systems. For example, the delivery device 2 is preferably suitable for interfacing with various accessories such as EVLT sheathes, spot handpieces and ENT accessories.

Information from the delivery device 2 is received by the laser device 1. Receiving information from the delivery device 2 preferably does not require any additional connection between the laser device 1 and the delivery device 2, and a contactless method of receiving information from the delivery device 2 is particularly preferred. According to the preferred embodiment an AC or RF tag or transponder 3 is embedded within or

provided on the delivery device 2. The data or information received by the laser device 1 from the delivery device 2 is preferably pre-assigned to the delivery device 2 during manufacture.

5 A reader for receiving information from the delivery device 2 is preferably provided within the laser device 1. The reader may collect data or information which is then transferred through standard interfaces to the control of the laser device 1.

10 The reader provided within the laser device 1 may read an RF or AC identification tag or transponder 3 provided on the delivery device 2. The reader preferably comprises an antenna, a transceiver and a processor. The RF or AC identification tag or
15 transponder 3 preferably comprises an antenna and an integrated circuit or silicon chip. The RF or AC identification tag or transponder 3 may be encapsulated in glass or plastic which may then be attached to the delivery device 2.

20 In an embodiment the identification tag or transponder 3 may be a passive system which remains in an OFF state until activated by a signal from the reader. Preferably, the identification tag or transponder 3 is of the type which does not require an
25 internal power source such as a battery.

 According to a preferred embodiment the AC or RF identification tag or transponder 3 is embedded within a moulding attached to the delivery device 2 e.g. optical fibre. The moulding is preferably attached to the
30 delivery device 2 or optical fibre approximately 5 cm from a connector which is used to connect the optical fibre 2 to the laser device 1. Thus, when the delivery

device 2 or optical fibre is attached to the laser device 1 the identification tag or transponder 3 remains external to the laser device 1.

According to other embodiments the delivery device 2 may comprise a barcode or colour identification tag which is preferably located within the housing of the laser device 1 when the delivery device 2 is connected to the laser device 1.

The delivery device 2 is preferably able to withstand Ethylene Oxide sterilisation and accordingly an encapsulated AC or RF identification tag 3 is particularly preferred.

The identification tag 3 may comprise a Read Only or a Read/Write device. The data held on the identification tag 3 may be pre-programmed onto the delivery device 2 during manufacture. If a Read/Write device is used the laser device 1 may update the information on the identification tag upon connection and may for example record the date and usage of the delivery device 2.

The information received by the laser device 1 is preferably displayed for the user on a display 4 which may be integral with the laser device 1. The information may be displayed, for example, as a series of messages and/or warning(s) based on the data exchanged.

The laser device 1 preferably automatically interrogates the delivery device 2 either upon connection of the delivery device 2 to the laser device 1 or upon switching the laser device 1 ON. Interrogation of the delivery device 2 at switch-on ensures that the laser device 1 detects whether a new

delivery device 2 has been attached and whether or not the delivery device 2 is properly attached. The laser device 1 may also detect whether the delivery device 2 has been changed since the laser system 10 was last
5 switched OFF. The laser device 1 preferably interrogates the delivery device 2 during or after completion of a self-test start-up procedure when the laser device 1 is first switched ON.

According to an embodiment an interrogating
10 electromagnetic pulse is preferably transmitted from the reader of the laser device 1. The interrogating pulse may be of radio wave frequency.

The AC or RF identification tag or transponder 3 is preferably powered by an electromagnetic field generated
15 by the reader. The antenna of the AC or RF identification tag or transponder 3 collects electromagnetic energy transmitted by the reader. When the power pulse has been received the AC or RF identification tag or transponder 3 transmits data to
20 the reader using the energy received.

In an embodiment the RF or AC identification tag 3 may comprise either a conductively coupled RF or AC identification tag or a capacitively coupled RF or AC identification tag. The conductively coupled RF or AC
25 identification tag may comprise a metal coil antenna powered by the magnetic field generated by the reader. A capacitively coupled RF or AC identification tag may comprise an antenna comprised of two plate electrodes. A capacitively coupled RF or AC identification tag is
30 powered by an electric field generated by the reader, the field gradient causing a charge build up between the plates and thus a potential difference.

In accordance with a less preferred embodiment a laser system 10 may be provided with an electromagnetic tag which operates at a low frequency (typically between 70 Hz and 1kHz).

5 Upon receiving the data from the delivery device 2 the laser device 1 may be activated if the data indicates that the delivery device 2 is in a usable condition. However, if the delivery device 2 is not usable, for example if its expiry date has passed or its
10 usage limit has been exceeded, then the laser device 1 may prevent or restrict further operation and/or may preferably provide the user with one or more warning messages.

 The laser device 1 may preferably receive
15 information from the delivery device 2 which pre-configures the laser device 1 for use. For example, the laser device 1 may set the properties of the laser radiation to be transmitted to the delivery device. The settings may, for example, include the output power
20 and/or pulse width and/or interval between pulses and/or the duration of the laser radiation. This may be particularly preferred in a medical laser device whereby the type of delivery device 2 and the settings for the laser device 1 may be specific to a particular
25 treatment.

 According to an embodiment a user may be allowed to override the laser system 10 to allow further limited use of the laser system 10, in for example emergency situations, when the laser device 1 has otherwise
30 prevented use of the delivery device 2. The override may be limited to a single occasion and may require resetting by service personnel. Alternatively a secure

tool may be provided for resetting the override function. The secure tool may, for example, comprise a dummy-delivery device comprising a tag 3, which transmits information to the laser device 1 and wherein the information resets the laser device 1. The secure tool may be limited to a single use. The display 4 of the laser device 1 may indicate when the override function has been used. A telephone link, serial connection, internet link or other connection may be provided for enabling/disabling the laser device 2 and for overriding the information exchange system.

In one preferred embodiment the override function may be limited to situations wherein the laser device 1 has not received information from the delivery device 2. Thus if the delivery device 2, for example, indicated to the laser device 1 that it was unsuitable for use since the expiry date of the delivery device 2 had passed then the user may not be allowed to override the system.

According to an embodiment the laser device 1 may only accept a delivery device 2 which transmits information to the laser device 1. According to another embodiment the laser device 1 may operate with any delivery device 2 but will interrogate the delivery device 2 for information before operation. In a preferred embodiment whether the laser device 1 only operates with a delivery device 2 which transmits information or with any delivery device may be selectable. The selection between these modes of operation may be restricted such that only trained service personnel may set the mode of operation of the laser device 1. For example, an internal switch may be provided or more preferably the system may be configured

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using a software engineering mode of the laser device 1.
This may be accessible via a telephone link, serial
connection or the internet. A secure tool, as
previously described, may also be used to configure the
5 system.

The delivery device 2 according to the preferred
embodiment is preferably suitable for use with existing
conventional laser devices which do not receive
information from the delivery device 2.

10 The laser device 1 is preferably able to
differentiate between separate delivery devices 2 such
that the laser device 1 does not interrogate delivery
devices other than the delivery device 2 actually
attached to the laser device 1.

15 The device for interrogating the delivery device 1,
such as an AC or RF identification tag reader or a bar
code reader, may be installed within a conventional
laser device. The receiving of information from the
delivery device 2 to the laser device 1 is preferably
20 software driven, controlled and switched. The
modification of a conventional laser device such that it
is operable in accordance with the preferred embodiment
preferably would not have any significant effect on the
overall size, weight or reliability of the laser device.

25 It will be appreciated that the above described
embodiments are given by example only and that various
modifications thereto may be made without departing from
the scope of the invention.

Claims

- 5 1. A laser system comprising:
a laser device for emitting laser radiation; and
a delivery device adapted to connect, in use, to
said laser device for delivering said laser radiation;
wherein, in use, said laser device receives
10 information from said delivery device.
2. A laser system as claimed in claim 1, wherein said
delivery device is an optical fibre.
- 15 3. A laser system as claimed in claim 1 or 2, wherein
said laser device includes a detector for detecting the
connection of said delivery device.
4. A laser system as claimed in claim 3, wherein, in
20 use, said laser device interrogates said delivery device
after said detector indicates that said delivery device
has been connected to said laser device.
5. A laser system as claimed in claim 1, 2 or 3,
25 wherein said laser device interrogates said delivery
device.
6. A laser system as claimed in any preceding claim,
wherein said laser device interrogates said delivery
30 device in a contactless manner.

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7. A laser system as claimed in any preceding claim, wherein said information is encoded on, embedded within or otherwise stored with said delivery device.

5 8. A laser system as claimed in any preceding claim, wherein said information indicates the type of said delivery device.

9. A laser system as claimed in any preceding claim,
10 wherein said information indicates the state, usage, expiry date, age or model of said delivery device.

10. A laser system as claimed in any preceding claim, wherein said information indicates the intended use or
15 function of said delivery device.

11. A laser system as claimed in any preceding claim, wherein said delivery device comprises an AC or RF identification tag or transponder.

20 12. A laser system as claimed in claim 11, wherein said AC or RF identification tag or transponder is a read only device.

25 13. A laser system as claimed in claim 11, wherein said AC or RF identification tag or transponder is a read/write device.

14. A laser system as claimed in any of claims 11, 12
30 or 13, wherein said laser device comprises an AC or RF identification reader for reading said AC or RF identification tag or transponder.

15. A laser system as claimed in claim 14, wherein, in use, said delivery device transmits or returns a signal to said AC or RF identification reader.

5

16. A laser system as claimed in any preceding claim, wherein said delivery device receives, in use, a power or electromagnetic pulse.

10 17. A laser system as claimed in any preceding claim, wherein said delivery device receives, in use, AC or RF energy, stores said energy, and transmits back to said laser device data or information using said stored energy.

15

18. A laser system as claimed in any of claims 1-10, wherein said delivery device comprises a barcode.

19. A laser system as claimed in claim 18, wherein said
20 laser device comprises a barcode reader.

20. A laser system as claimed in any of claims 1-10, wherein said delivery device comprises a colour identification tag.

25

21. A laser system as claimed in claim 20, wherein said laser device comprises means for identifying said colour identification tag.

30 22. A laser system as claimed in any preceding claim, wherein said laser device comprises a SMA-905 connector for receiving an optical fibre.

23. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
prevents operation with said delivery device upon
5 receiving information from said delivery device.

24. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
prevents operation with said delivery device if said
10 laser device does not receive any information from said
delivery device.

25. A laser system as claimed in any preceding claim,
wherein said laser device prevents operation if a
15 delivery device known per se is connected to said laser
device.

26. A laser system as claimed in claim 25, wherein the
delivery device known per se does not transmit
20 information to said laser device.

27. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
prevents operation with said delivery device if said
25 laser device receives information from said delivery
device and wherein said information indicates a
predetermined parameter.

28. A laser system as claimed in claim 27, wherein said
30 parameter indicates the usage of the delivery device.

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29. A laser system as claimed in claim 27 or 28,
wherein said parameter indicates the sterility of the
delivery device.

5 30. A laser system as claimed in claim 27, 28 or 29,
wherein said parameter indicates the type of the
delivery device.

31. A laser system as claimed in any of claims 27-30,
10 wherein said parameter indicates an expiry date of the
delivery device.

32. A laser system as claimed in any preceding claim,
wherein said laser device may be enabled and/or disabled
15 remotely.

33. A laser system as claimed in claim 32, wherein said
laser device may be enabled and/or disabled via a
telephone link, serial interface or via the internet.

20 34. A laser system as claimed in any preceding claim,
wherein said laser device further comprises a visual
display, said display being adapted to provide the user
with information received from said delivery device.

25 35. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
receives information from said delivery device and sets
the power of laser radiation to be transmitted to said
30 delivery device.

36. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
receives information from said delivery device and sets
the pulse width of laser radiation to be transmitted to
5 said delivery device.

37. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
receives information from said delivery device and sets
10 the interval between pulses of laser radiation to be
transmitted to said delivery device.

38. A laser system as claimed in any preceding claim,
wherein in a mode of operation said laser device
15 receives information from said delivery device and sets
the duration that laser radiation is to be transmitted
to said delivery device.

39. An optical fibre assembly comprising an AC or RF
20 identification tag or transponder.

40. A laser device comprising a reader for reading an
AC or RF identification tag or transponder on an optical
fibre assembly.

25

41. A laser system comprising:
an optical fibre assembly comprising an AC or RF
identification tag or transponder; and
a laser device comprising a reader for reading said
30 AC or RF identification tag or transponder.

42. An optical fibre comprising a barcode.

43. A laser device comprising a barcode reader for reading a barcode on an optical fibre.
- 5 44. A laser system comprising:
an optical fibre comprising a barcode; and
a laser device comprising a barcode reader for reading said barcode.
- 10 45. A laser system comprising:
a laser device for emitting laser radiation; and
a delivery device adapted to connect, in use, to said laser device for delivering said laser radiation, said delivery device comprising a read/write device for
15 storing information;
wherein, in use, said laser device updates said information on said read/write device.
- 20 46. A medical laser device comprising a laser system as claimed in any of claims 1-38, 41, 44 or 45.
47. A method of operating a laser system comprising the steps of:
providing a laser device; and
25 connecting a delivery device to said laser device;
wherein said laser device receives information from said delivery device.
- 30 48. A method as claimed in claim 47, wherein said delivery device comprises an optical fibre.

49. A method as claimed in claim 47 or 48, wherein said laser device interrogates said delivery device.

50. A method of operating a laser system comprising:
5 providing a laser device and a delivery device
wherein said laser device interrogates said delivery device.

51. A method as claimed in claim 50, wherein said laser
10 device detects the attachment of said delivery device
prior to interrogating said delivery device.

52. A method of operating a laser system comprising the steps of:
15 providing a laser device; and
attaching a delivery device to said laser device;
wherein said laser system detects the attachment of
said delivery device and interrogates said delivery
device upon detection of the attachment of said delivery
20 device.

53. A method as claimed in any of claims 47-52, wherein
said laser device enables operation of said laser system
upon receiving information from said delivery device.
25

54. A method as claimed in any of claims 47-53, wherein
said laser device receives information from said
delivery device and displays said information for the
user.

30
55. A method as claimed in any of claims 47-54, wherein
said laser device receives information from said

delivery device indicating the usage of the delivery device.

56. A method as claimed in any of claims 47-55, wherein
5 said laser device receives information from said delivery device indicating the sterility of the delivery device.

57. A method as claimed in any of claims 47-56, wherein
10 said laser device receives information from said delivery device indicating the type of the delivery device.

58. A method as claimed in any of claims 47-57, wherein
15 said laser device receives information from said delivery device indicating the expiry date of the delivery device.

59. A method as claimed in any of claims 47-58, wherein
20 in a mode of operation said laser device is enabled and/or disabled remotely.

60. A method of operating a laser system comprising the steps of:
25 providing a laser device;
attaching a delivery device to a laser device; and
transmitting a power pulse to said delivery device;
wherein said delivery device receives said pulse,
stores said pulse and transmits data to said laser
30 device using said pulse.

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61. A method as claimed in claim 60, wherein said pulse is a pulse of AC or RF energy.

62. A method as claimed in any of claims 47-61, wherein
5 said laser device receives information from said
delivery device and configures the operation of said
laser device.

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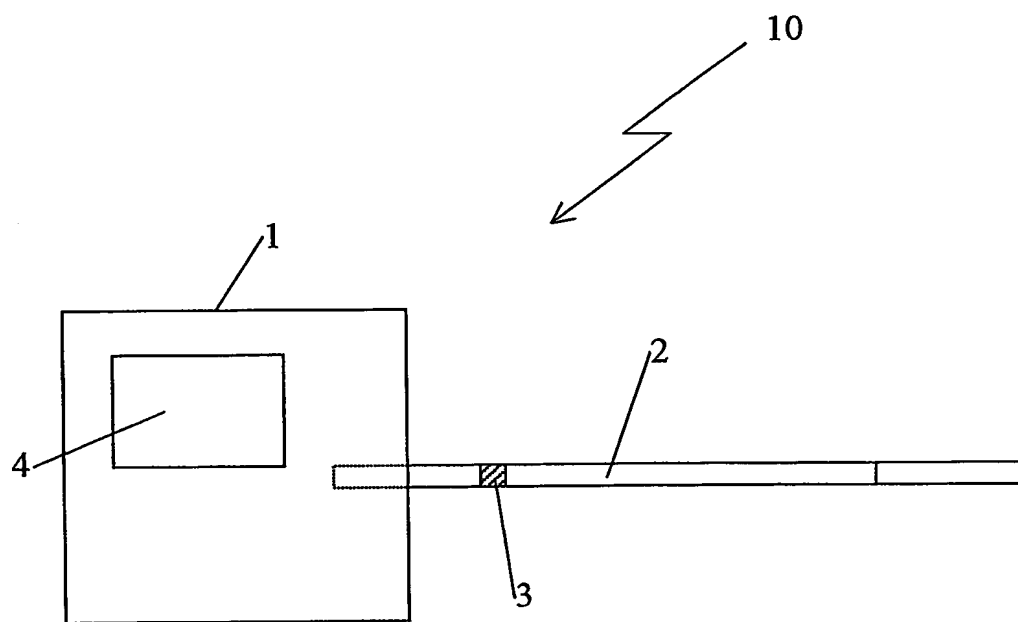


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/03205

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B18/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B H01S G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 473 987 A (ZEISS STIFTUNG ;SCHOTT GLASWERKE (DE)) 11 March 1992 (1992-03-11) abstract; column 1, line 5 - line 8; column 2, line 16 - line 53; column 3, line 37 - line 49; column 5, line 20 - line 42; figure 1; claims 1, 10	1-38,40, 41,43, 44,46-61
X	EP 0 408 160 A (TOPCON CORP) 16 January 1991 (1991-01-16) abstract; column 3; line 4 - line 28; column 4, line 21 - line 23; figure 3; claims 1, 6 -/--	1-9,16, 18,19, 34,35, 42-44, 46-52,62

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
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X	<p>EP 0 867 151 A (TERUMO CORP) 30 September 1998 (1998-09-30)</p> <p>abstract; column 5, line 16 - line 33; column 6, line 35 - column 7, line 13; column 8, line 46- column 9, line 28; figure 1</p>	<p>1-5, 7-10, 16, 30, 34, 46-54, 57, 62</p>
X	<p>US 6 293 467 B1 (SHEPARD PHILLIP W ET AL) 25 September 2001 (2001-09-25) abstract; column 3, line 1 - line 10; column 5, line 35 - line 38;</p>	42-44, 50
X	<p>US 2002/034365 A1 (VOGELSANG HORST) 21 March 2002 (2002-03-21) paragraphs '0012!', '0019!', '0033!', '0034!; figure 1</p>	39
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